EFFECT OF ENVIRONMENTAL CONDATION ON AFLATOXINE CONTAMINATION INPORTED YELLOW CORN GRAINS

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INTRODUCTION

Corn is widely cultivated throughout the world, and a greater weight of corn is produced each year than any other grain. The United States produces 40% of the world's harvest; other top producing countries include China,Brazil, Mexico, Indonesia, India, France and Argentina. Worldwide production was 817 million tones in 2009 more than rice (678 million tons) or wheat (682 million tons). (Food and Agriculture Organization of the United Nations, 2012). , In 2012, over 159 million hectares (390 million acres) of corn were planted worldwide, with a yield of over 5 tons/hectare (80 bu/acre). Production can be significantly higher in certain regions of the world; 2009 forecasts for production in Iowa were 11614 kg/ha (185 bu/acre) (International Grains Council, 2013).

Aflatoxin contamination has been reported for grains as corn, soya, wheat, rice, and cotton seed, and nuts such as peanuts, almonds, Brazil nuts, hazelnuts, walnuts, cashew nuts, pecans, and pistachio nuts (Gürses, 2006).

Kumar *et al*. (2000) reported that Aflatoxins develop in corn in the field and during storage thus making the grains unwholesome for consumption. The predisposing factors of infection include improper drying, high relative humidity and temperature, farmers' production practices- intercropping with aflatoxin infected grains- early and delayed harvesting and poorly constructed storage structures. Corn predisposed to some of these factors has a high 3 probability of fungal infection (Aspergillus sp) which may, presumably enhance the development of aflatoxins. It is therefore assumed that, since climatic conditions, especially rainfall, temperature and relative humidity as well as storage structures vary in the country, the infection of corn by fungi (Aspergillus sp) and the subsequent development of aflatoxin may also vary. Figure1.1. shows a corn cob infested by fungi in the field.

Dorner and Cole (2002) reported that Atoxigenic strains, like aflatoxin-producing fungi, become associated with corps in the field during crop production. These fungi remain with the harvested corps after harvest and in storage. Since crop contamination with aflatoxins may occur in the field, in storage or anytime until the crop is consumed, if conditions are conducive for fungal growth, e.g., high humidity and high temperature, then crop infection and contamination will continue as well. Like their aflatoxin- producing relatives, atoxigenic strains also move into storage with the crop and provide residual protection in transport, storage, and processing until consumption.

Moisture is not a grading factor in commercial grain. However, a loss of quality in stored corn hinges largely on the amount of moisture present in the grain. Moisture is an important factor most discount schedules. Moisture is recorded on the grain certificate to the nearest tenth of a percent (USDA) Official Grain Standards of the United States Federal Grain Inspection Handbook (2009).The presence and growth of Aspergillus on pre-harvested crops can be reduced through agricultural practices such as proper irrigation and pest management. Pre-harvest interventions include choosing crops with resistance to a biotic stresses (like drought, temperature and moisture content) and reducing crop stresses in general, developing host resistance through plant breeding, and choosing varieties that are genetically more resistant to fungal growth and aflatoxins production, diseases and pests. However, these processes may not be economically feasible in many high-risk regions. The use of staple crops resistant to fungal colonization or genetically modified crops that inhibit fungal invasions (transgenic crops), joined to the elimination of inoculum sources (such as infected debris from the previous harvest) may prevent infection of the crop. Years before, the use of fungicides, pesticides and in secticides were a good way for controlling infections, but nowadays, the use of biocontrol agents is the most appropriated in order to avoid consumers chemical intoxications. For example, biopesticides consisting of a non aflatoxigenic strain of Aspergillus may competitively exclude toxic strains from infecting crops, but the allergenic and human health aspects of the toxigenic strain need still to be evaluated. Aflatoxins M1 and M2 (whose names are derived from milk aflatoxins, and then related to meat aflatoxins too), are thermo-resistant hydroxylated metabolites produced by lactating animals consuming aflatoxin contaminated feeds. The ingested AFB1 and AFB2 are metabolized by livestock into AFM1 and AFM2 respectively, with estimated conversion ratio of 1–3% between AFB1 and AFM1 (Herzallah, 2009).

MATERIALS AND METHODS

Yellow Corn Samples had been collected from Ukrainian, Argentina, Bulgarian, Romanian, American, Hungarian, Serbian, Brazilian and Egyptian stored corn in silos and warehouses in ports of Alexandria, Damietta, and Dekhila . Samples had been divided, graded and kept in cloth bags and stored for three months period at ambient environmental condition.

Experimental Design:

Eight samples had been used as experimental groups **(**Ukrainian, Argentina, Bulgarian, Romanian, American, Hungarian, Serbian and Brazilian), while Egyptian Yellow Corn sample had been used as control group. 25 kg of each type of corn (Egyptian, Brazilian, American, ….etc.) had been collected. 3 samples of each type of corn had been prepared for grading test (3 samples x 4 periods of times 0, 30, 60 and 90 days).

Total weight required for grading tests = 1050 gm*12= 12600

Residual weight = 25000-12600= 12400 kg

The residual weight had been used for aflatoxin and microbial tests 12400/3*12 = 344.4 gm.

The total weight used for tests = 25 Kg X 9 types of corn = 225 kg.

Weather conditions:

The study had been conducted in the period from 1st August to the 30th November, 2012. This period is divided into thee sub-intervals (0-30 days), (30-60 days) and (60-90 days) as shown in Table (1).

- Springfield device Model# 91551-W had been used for measuring both temperature and humidity

Table (1): Mean of the temperature and relative humidity through the previously mentioned period.

Period	0-30 days	30-60 days	60-90 days
Average temperature	34	30	29
Average Humidity	58.5	57.5	58

Determination of moisture content:

Moisture content was determined by using Jag 2100 device as shown in Fig. (1).

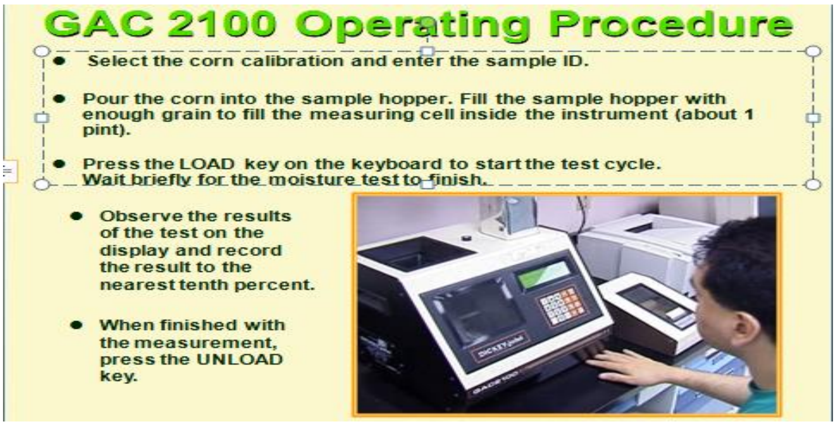
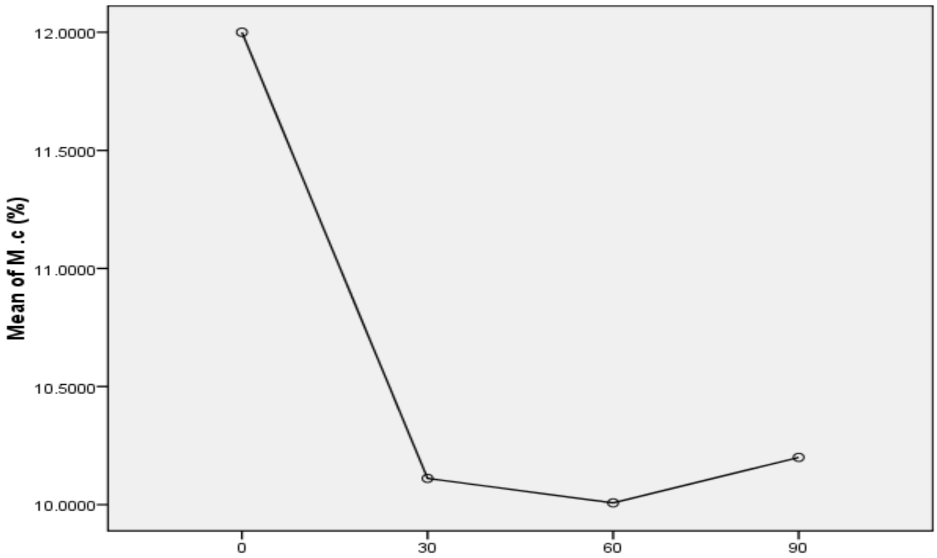


Fig. (1): GAC 2100 device for moisture content determination.

RESULTS AND DISCUSSION



Storage periods (days)

Fig. (1): Mean of moisture content (%) with storage periods (days).

It is clear from the abave fig. that the moisture content sharply decreases from 0 time to 30 days and then slightly decrease from 30 days to 60 days , then slightly increases in the period from 60 days to 90 days. This can be explained as follows, at zero time, the imported corn usually has moisture content doesn't exceed 15%, while in the period from zero time to 30 days , the moisture content decreases dramatically due to the storage in the summer (August), but then it decreases slightly due to relative decrease in temperature in the month of September. In the period from 60 days to 90 days, the moisture content starts to increase due drop in temperature in the month of October and due to increase in air moisture due to raining in this period.

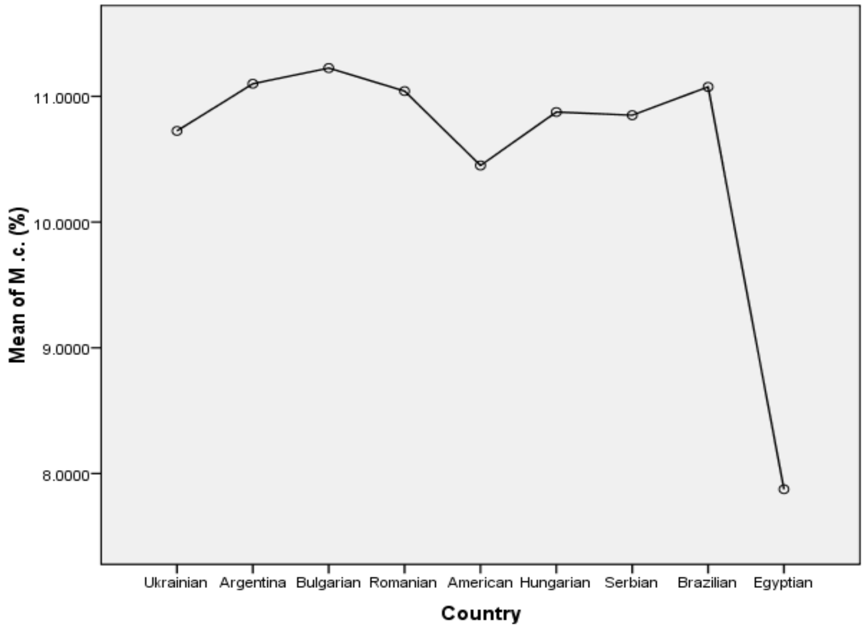


Fig. (2): The relation between the mean of the moisture content (%) and the countries.

The above figure shows that Egyptian corn has the lowest moisture content while the maximum moisture content refers to Argentinean corn and Brazilian corn respectively. This means that Egyptian corn has great advantage of lowest moisture content but unfortunately, the production is low.

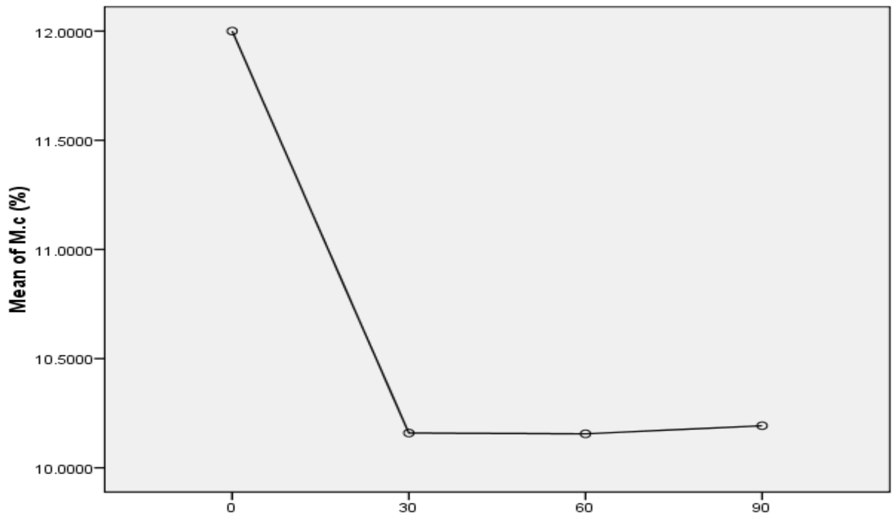


Fig. (3): Relation between M.C. (%) and storage periods in (days).

The above figure shows that the mean of the moisture content (%) is at its highest value at zero time and decrease after 30 days and remains constant in the period from 30 to 60 days while it slightly increases in the period from 60 to 90 days. At zero time the moisture content is in its highest value because the imported corn grains passed the test that determine the moisture content of the grain. Then the grain moisture content decreases due to environmental conditions during the storage period from zero time to 30 days and remains approximately constant in the period from 30 to 90.

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